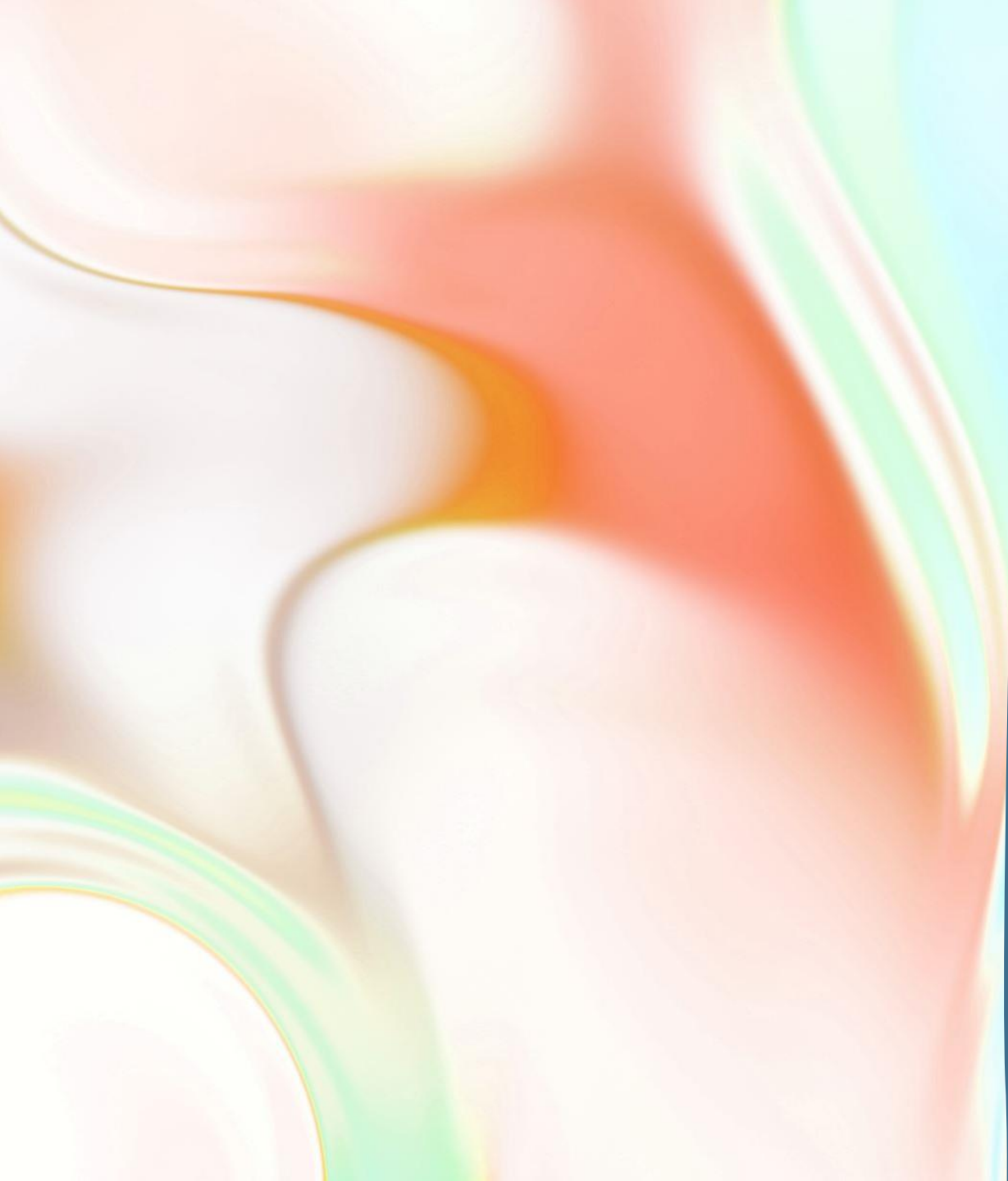




Understanding the Self

Intelligence



Lecture outline

- Definitions of intelligence
 - Two major approaches
 - Psychometric
 - Cognitive processes
 - General intelligence 'g'
 - Multiple intelligences
- Measuring intelligence
- Genetic and environmental influences

Intelligence

- Definitions of intelligence are hotly contested
 - Generally defined as “the capacity to learn from experience and adapt to one’s environment”
 - There are many theories of intelligence

Theories of intelligence: Two major approaches

1. Psychometric Approach

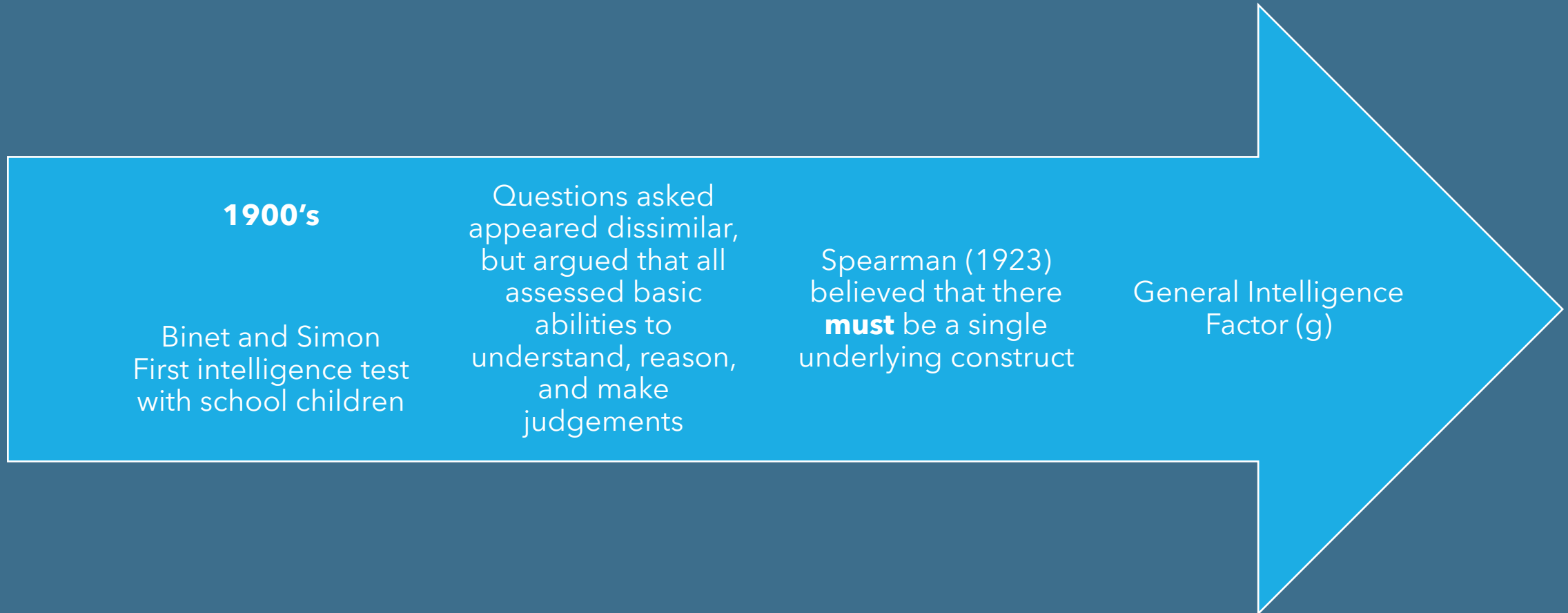
- Underlies most definitions of intelligence
- 'Mapping' the structure of intellect
- Identifying mental competencies that underlie test performance
- Analysis of scores on intelligence tests

2. Cognitive Processes (or Information Processing) Approach

- Focus on specific thought processes underlying mental competencies
- 'Intelligence': the steps or processes involved in solving problems

Psychometric Approach

Spearman's General Intelligence



Psychometric Approach

Spearman's General Intelligence

- Nowadays, it is widely accepted that intellectual performance is determined partly by a general intelligence factor; the **'g' factor**
 - **'g'** constitutes core intelligence
 - Noted as important predictor of both academic and job performance
- Also determined partly by whatever special abilities might be required to perform a particular task

Psychometric Approach

Thurstone's Primary Mental Abilities (1938)

- Challenged Spearman's 'g' factor
 - Only moderate correlations between different mental tasks
- Proposed that human mental performance depends on seven distinct – **primary** – mental abilities

Psychometric Approach

Thurstone's Primary Mental Abilities (1938)

Thurstone's Primary Mental Abilities	
Ability name	Description
M – Memory	Memorisation
N – Numerical ability	Dealing with numbers
P – Perceptual speed	Recognising visual patterns
R – Reasoning	Dealing with novel problems
S – Spatial	Reasoning about visual scenes
V – Verbal Comprehension	Understanding verbal statements
W – Word fluency	Producing verbal statements

Psychometric Approach

Fluid and Crystallised Intelligence (Cattell, 1963)

General intelligence consists of **fluid** and **crystallised** intelligence

Fluid intelligence:

- Comprehension, reasoning, problem solving

Crystallised intelligence:

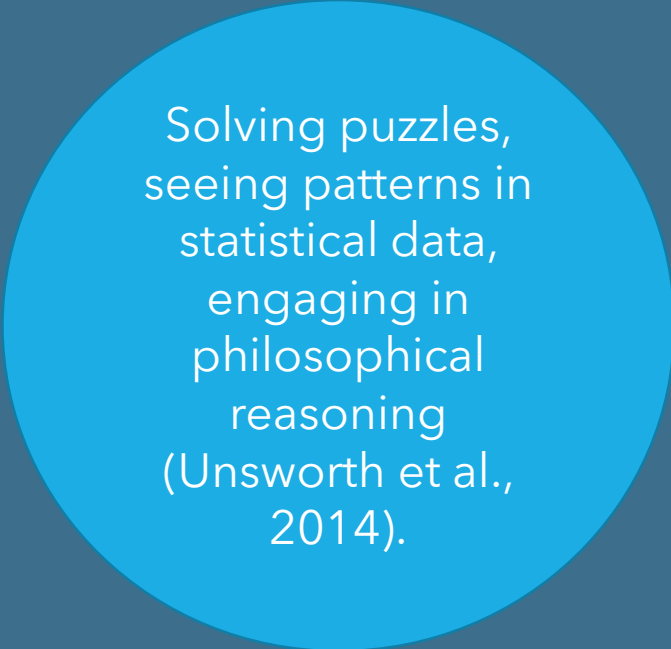
- Recalling stored knowledge and past experiences

Psychometric Approach

Fluid and Crystallised Intelligence (Cattell, 1963)

- **Fluid Intelligence:**

- Involves deductive reasoning and creativity
 - Requires the abilities to reason abstractly, think logically, and manage information within working memory
 - Correlated with comprehension and learning
-
- Fluid intelligence declines as people enter later adulthood



Solving puzzles,
seeing patterns in
statistical data,
engaging in
philosophical
reasoning
(Unsworth et al.,
2014).

Psychometric Approach

Fluid and Crystallised Intelligence (Cattell, 1963)

- **Fluid Intelligence:**

- Horn (1969) – Fluid intelligence is formless; relies minimally on prior learning
- Peaks during late 20's before gradually declining (Cacioppo & Freberg, 2012)

Psychometric Approach

Fluid and Crystallised Intelligence (Cattell, 1963)

- **Crystallised Intelligence:**

- Applying previously acquired knowledge to current problems
- Based on ability to retrieve previously learned information from long-term memory
- Rises gradually and remains stable throughout adulthood until it begins to decline after age 60 (Cavanaugh & Blanchard-Fields, 2006)



Recalling events and dates, remembering geographical locations, reciting texts (Horn, 1968)

Psychometric Approach

Fluid and Crystallised Intelligence (Cattell, 1963)

- **Crystallised Intelligence:**
 - Horn (1969) – Crystallised intelligence results from accumulated knowledge of reasoning, language abilities and understanding technology, etc.
 - Linked to education and experience; can be measured by tests of general information

Psychometric Approach

Fluid and Crystallised Intelligence (Cattell, 1963)

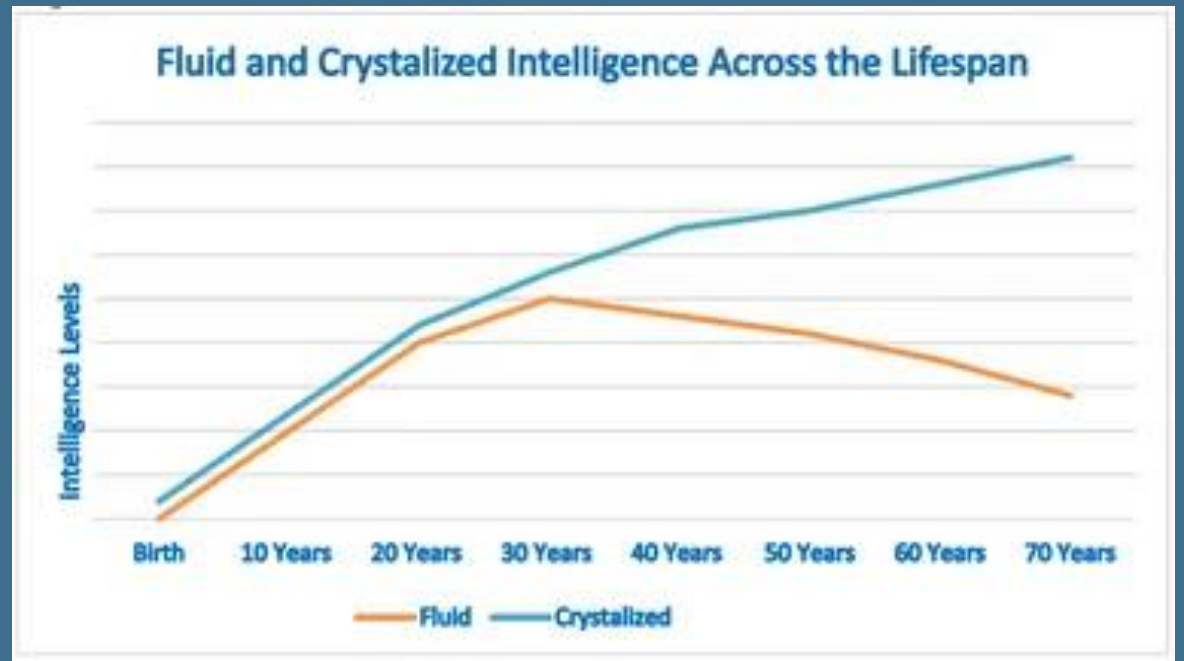
- **Not entirely distinct entities**
 - Both required to work together
 - E.g., situation that requires utilising fluid intelligence to construct a strategy and using crystallised intelligence to recall previous situations
 - Crystallised intelligence is **not** fluid intelligence that has crystallised over time

Psychometric Approach

General intelligence
(G)

Fluid intelligence -
solving new
problems

Crystallised
intelligence -
use of existing
knowledge



- Psychometric approaches are statistically sophisticated ways of:
 - Providing a map of the mind
 - Describing how people are different from one another
- But they do not explain why people vary in these mental skills

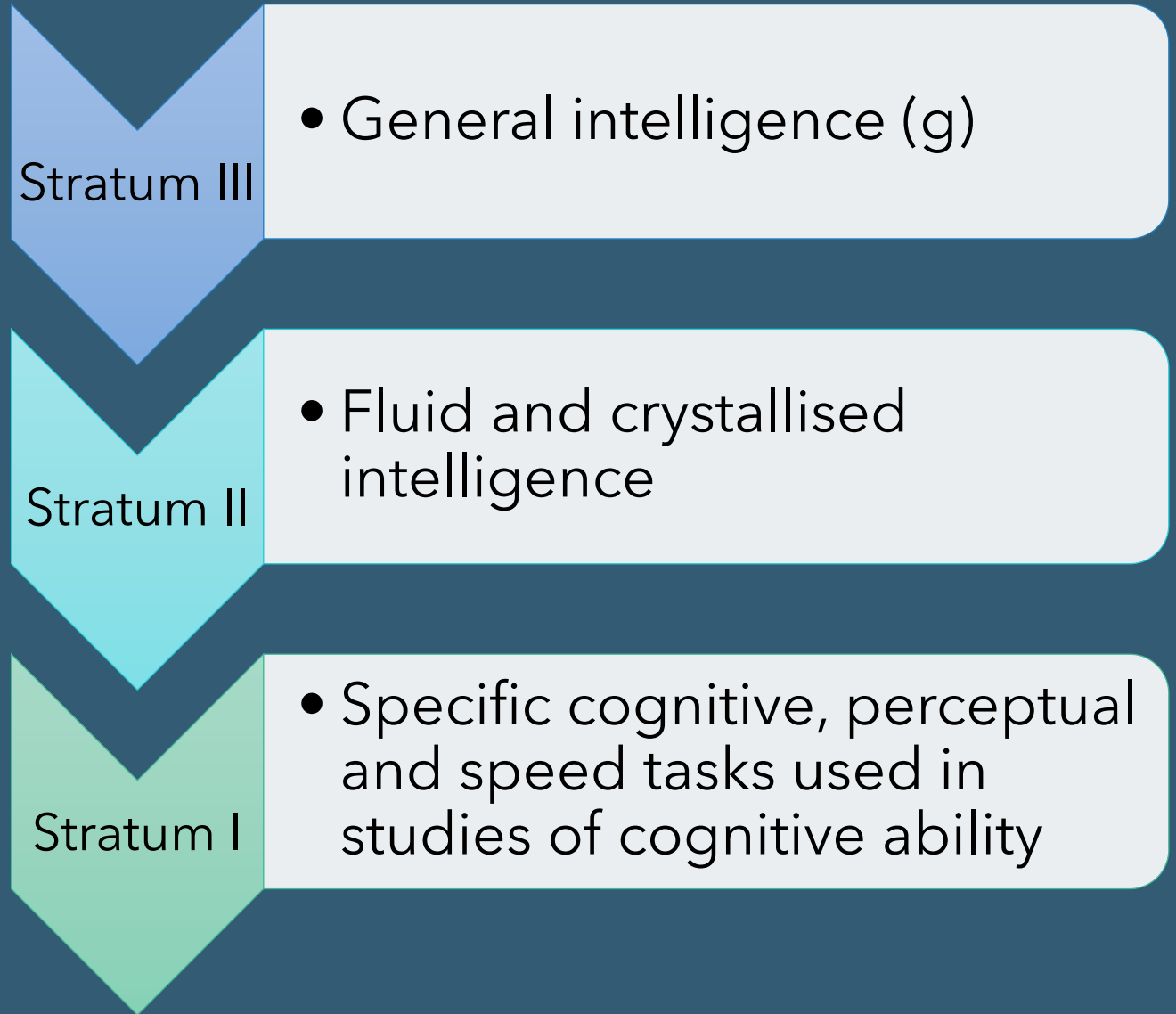
Psychometric Approach

Carroll's Three Stratum Model (1993)

- Integrative model of intelligence – contains elements of Spearman's, Thurstones and Cattell-Horn's models
- Hierarchical model - three levels of mental skill: general, broad and narrow
 - Carroll – model encompasses almost all known cognitive abilities

Psychometric Approach

Carroll's Three Stratum Model (1993)



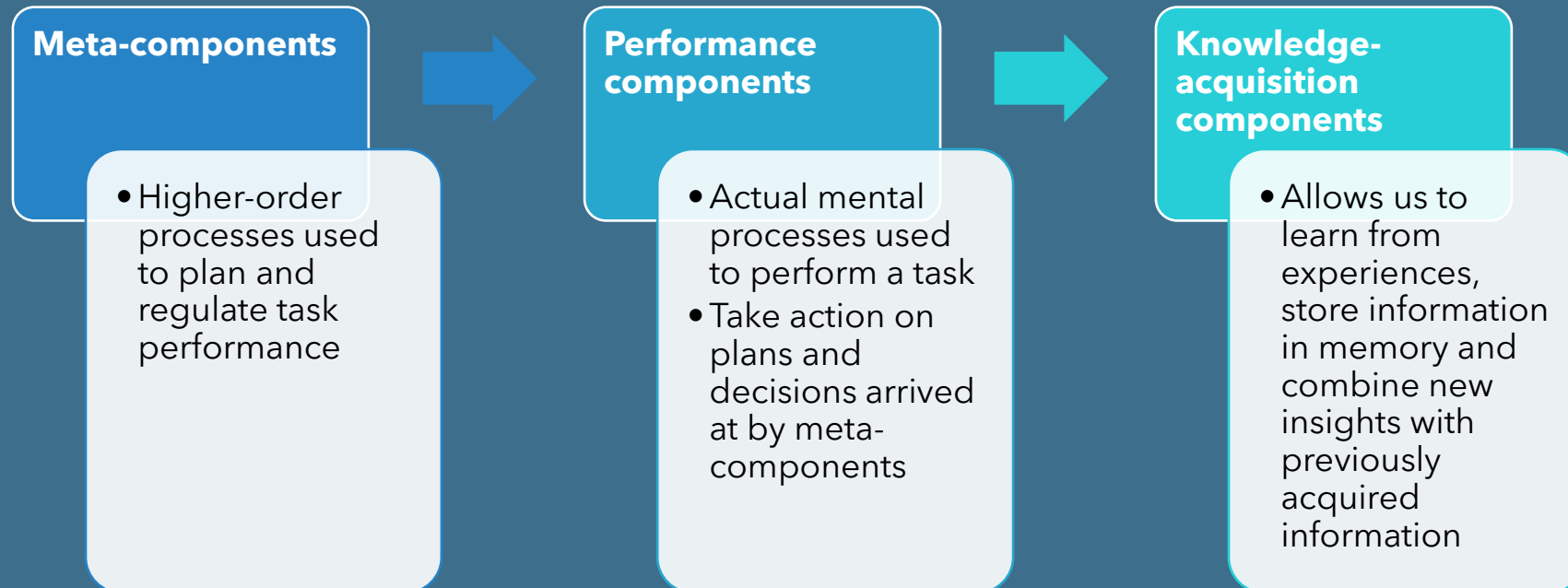
Cognitive / Information Processing Approach

- Explores specific information processing and cognitive processes that underlie intellectual ability
- **Sternberg's Triarchic Theory of Intelligence**
 - Based on the idea that there are multiple intelligences
 - 'g' only assesses academic intelligence
 - Addresses both the psychological processes involved in intelligent behaviour and the diverse forms that intelligence can take

Cognitive / Information Processing Approach

Sternberg's Triarchic Theory

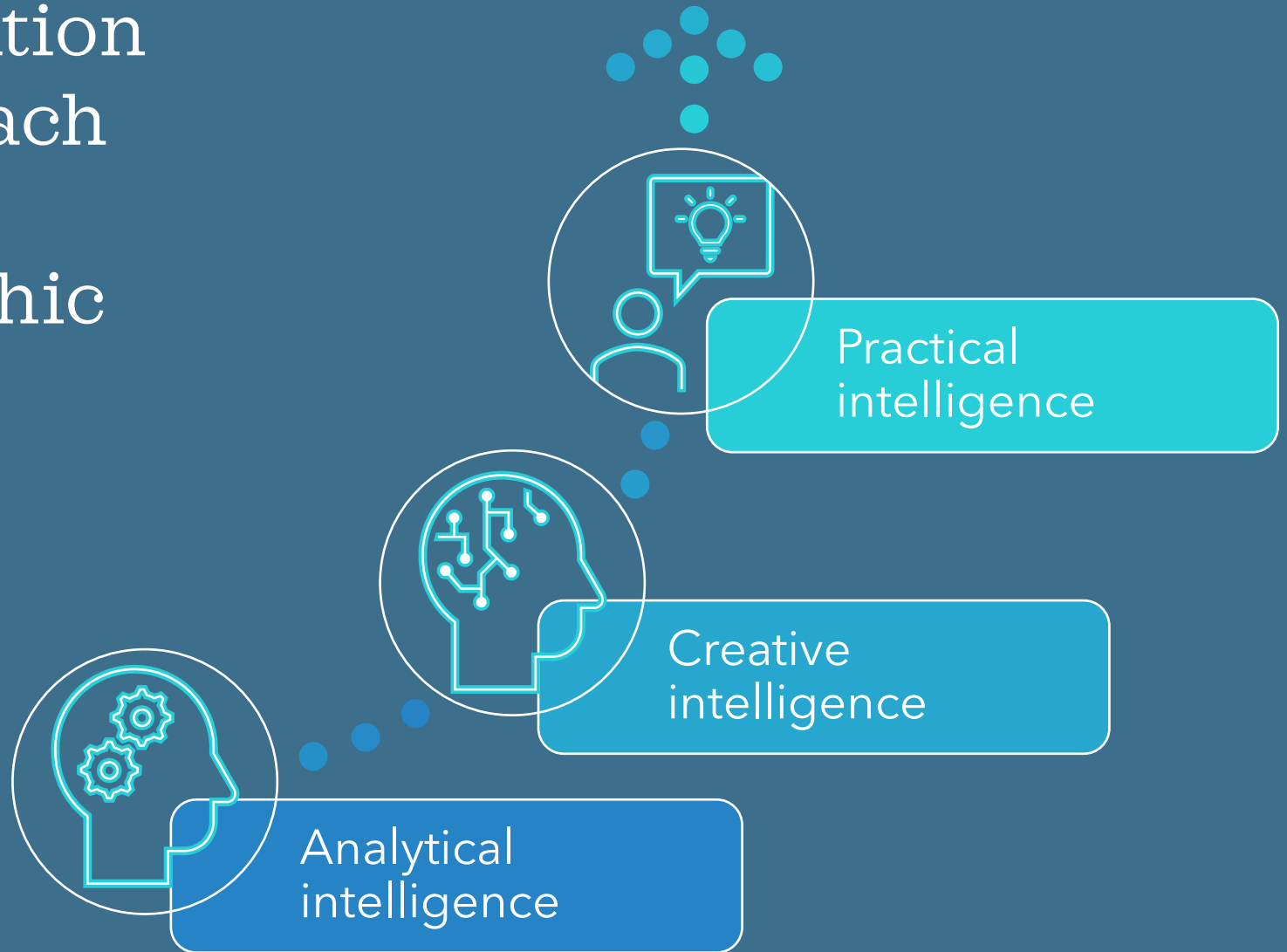
Divides cognitive processes into three specific components:



Cognitive / Information Processing Approach

Sternberg's Triarchic Theory

Three kinds of intelligence:



Cognitive / Information Processing Approach

Gardner's Theory of Multiple Intelligences

Intelligence	Description
Linguistic	Ability to speak and write well
Logico-mathematical	Ability to use logic and mathematical skills to solve problems
Spatial	Ability to think and reason about objects in 3D
Musical	Ability to perform and enjoy music
Kinaesthetic (body)	Ability to move the body in sports, dance, or other physical activities
Interpersonal	Ability to understand and interact effectively with others
Intrapersonal	Ability to have insight into the self
Naturalistic	Ability to recognise, identify, and understand animals, plants and other living things

Cognitive / Information Processing Approach

Gardner's Theory of Multiple Intelligences

- Evidence for multiple intelligences comes from savant syndrome
 - **Savant syndrome:** individuals who appear intellectually deficient (based on traditional definitions/measurement of intelligence), but display exceptional abilities in a specific area (or areas)



Measuring Intelligence

Measuring Intelligence

- Goal of most intelligence tests is to measure g .
- Intelligence tests must have good **psychometric properties**
- Psychometric = measure of the mind
- Psychometric properties = reliability, validity, and standardisation (and norming)

Measuring Intelligence

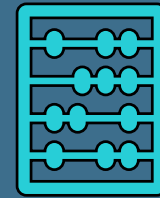
- A good psychometric test must have three fundamental properties:



Psychometric
Reliability



Psychometric
Validity



The Practice of
Norming -
Standardisation

Measuring Intelligence

Reliability

- Good intelligence tests are reliable
 - ***They are consistent over time***
- While a persons score may vary slightly with age and environmental condition, intelligence tests are repeatable and will generally be consistent from one time point to another

Measuring Intelligence

Validity

- Good intelligence tests are valid
 - ***They measure what they say they are measuring***
- An IQ test has construct validity if it demonstrates an association between test scores and the prediction of a theoretical trait
 - Accurately measuring intelligence rather than another characteristic, such as memory or education level

Measuring Intelligence

Standardisation (Norming)

- Standardisation – giving a test to a large number of people at different ages and computing the average score on the test at each age level
 - Can then compare against norms
- Intelligence changes with age
- Regular standardisation of intelligence tests is essential
 - Flynn Effect

Measuring Intelligence

- Binet – developed intelligence testing (work with SEN children)
- Intelligence established by assessing a person's mental abilities and comparing them with the abilities of other people (numerical comparison)
- Stern (1912): formula of Intelligence Quotient (IQ)
 - Based on an operational definition of intelligence

$$\text{IQ} = \frac{\text{mental age}}{\text{chronological age}} \times 100$$

Measuring Intelligence

Weschler Adult Intelligence Scale (WAIS tests)

- Weschler Adult Intelligence Scale (Watkins et al., 1995)
 - Most recent WAIS-IV (2008) standardised on 2,200 people (16-90)
 - WAIS-V testing ongoing
- Battery of sub-tests focusing on four specific domains of intelligence (index):

Verbal
Comprehension

Perceptual
Reasoning

Working
Memory

Processing
Speed

Measuring Intelligence

Weschler Adult Intelligence Scale (WAIS tests)

- Two broad scores are generated, which can be used to summarise general intellectual agilities
 - Full Scale IQ (FSIQ), based on total combined performance of **all** indexes
 - General Ability Index (GAI), based only on the six subtests that comprise the Verbal Comprehension Index and the Perceptual Reasoning Index
- Reliability around .95 (very high)

Measuring Intelligence

Other Weschler measures

- Wechsler Primary and Preschool Scale of Intelligence (WPPSI-III)
 - Suitable for assessing IQ in preschool children
- Wechsler Intelligence Scale for Children (WISC-IV).
 - Suitable for assessing IQ in older children and adolescents

Measuring Intelligence

Stanford-Binet Test

- Stanford-Binet Test measures intelligence through **five** factors of cognitive ability and generates a single (combined) score indicating IQ.
 - Fluid reasoning
 - Knowledge
 - Quantitative reasoning
 - Visual-spatial processing
 - Working memory
- Both verbal and non-verbal responses are measured

Measuring Intelligence

Achievement and Aptitude Testing



Aptitude tests

- Measure ability to perform a task or ability to learn a skill/subject
- Assesses potential for future learning
- E.g., education, undergraduate, post-graduate, etc

Achievement tests

- Assess knowledge in certain academic areas
- Based upon mastery of content
- Focus on previous learning

Importance of IQ scores

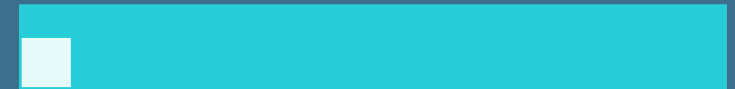
- Challenged in recent years
 - Abilities tested by IQ tests bear little relation to real-life success
 - 'Misses the point' in conceptualising cognitive abilities
- Alternative / novel abilities considered:
 - E.g., social, practical and emotional intelligence
 - Encompass abilities that involve emotionally-salient information
 - 'cool' and 'hot' intelligences

Cool



■ Abilities involving perceptual processing and logical reasoning

Hot



■ Abilities involving emotionally-salient information



Genetic and Environmental Influences



Genetic and Environmental Influences

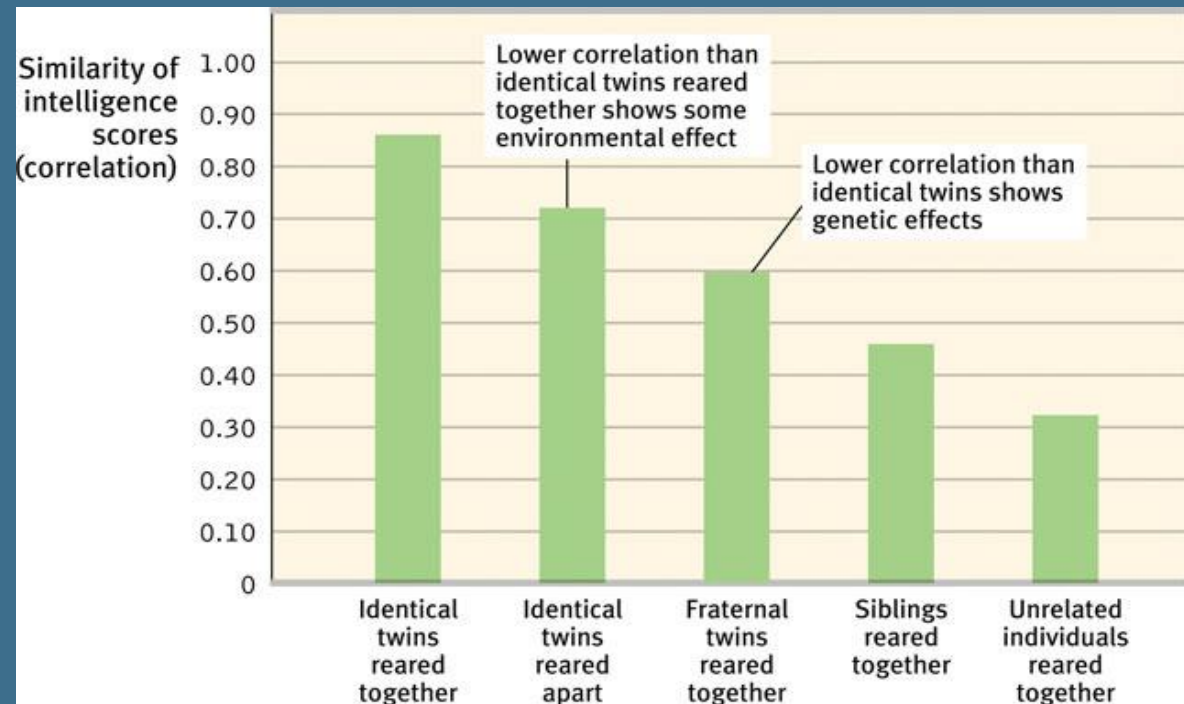
- Heredity
 - Genetic factors can influence the effects produced by the environment
 - There is no single 'intelligence gene'
- Environment can influence how genes express themselves
 - Both shared and unshared environmental factors are involved
 - Educational experiences are important

Genetic and Environmental Influences

Minnesota Study of Twin Reared Apart

- Studies of twins, family members, and adopted children suggest a significant genetic contribution to intelligence

(Bouchard & McGue, 1981)



Genetic and Environmental Influences

- The greater the similarity in genetic make up, the more similar they tend to be in IQ
 - The greater the **concordance** between their IQ scores
- Parents and biological children $r = .42$
- Parents and adopted children $r = .19$
- Genetic factors considered more important as people age (Plomin & Spinath, 2004)

Genetic and Environmental Influences

- Environmental factors also explain a greater proportion of the variance in intelligence for children from lower-class households than they do for children from upper-class households (Turkheimer et al., 2004)
- Social and economic deprivation can adversely effect IQ
 - Children living in poverty have lower IQ's than children who do not live in poverty (even when other factors are controlled for – Brooks-Gunn & Duncan, 1997).
- Intelligence is improved by education
 - Year spent correlates at approximately $r = .60$ (Ceci, 1991)

Summary

- Intelligence is the ability to think, to learn from experience, to solve problems, and to adapt to new situations
- General intelligence - g - is considered important in accounting for the overall differences in intelligence among people
- Evidence for specific (multiple) intelligences is overwhelming
- IQ is a measure of intelligence that is adjusted for age
- Differentiation between Cool and Hot intelligences forms much of the debate of IQ testing
- Intelligence is proposed to be influenced by both genetic and environmental influences